Canada. National Development Bureau
Asbestos; with special reference to Canada.

ASBESTOS

WITH SPECIAL REFERENCE TO CANADA

Natural Resources Intelligenee Service
Department of the Interior
Ottawa, Canada
1926

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Prefatory Note

This memorandum describes briefly the different phases of the asbestos industry in the world generally, with special reference to Canada. Further available information will be gladly sent to enquirers writing to the Mines Branch, Department of Mines, Ottawa, or to the Natural Resources Intelligence Service, Department of the Interior, Ottawa.

Much of the information contained in this memorandum has been compiled from data in Canadian and foreign governmental reports; in a few instances unofficial sources have been consulted, the information from which cannot be guaranteed to be accurate.

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ASBESTOS

HISTORICAL

Asbestos has been known since the time of the early Romans. It is mentioned by Marco Polo in the thirteenth century, and even Charlemagne is supposed to have entertained and mystified his guests by committing his table covers of "asbestos" to the flames.

The first modern attempt to exploit asbestos deposits was made during the year 1862 in the Aosta valley of the Italian Alps; and almost simultaneously with the exploitation in Italy asbestos was discovered in the Des Plantes river region, province of Quebec. These deposits upon development were comparatively limited, and all attempts to work them profitably failed.

In 1877, however, asbestos was found in another district in Quebec; this time in the serpentine hills of Thetford and Coleraine. During the next year mining operations commenced on a small scale. The quality of ~~the fibre mined~~ was excellent and the width of the veins was everything that could be desired; being from ½ inch up to 2 or 3 inches and sometimes 4 inches.

In early days of the industry only the crude fibre had any value; milled fibre was unthought of. Thus, the best, the longest and the silkiest asbestos was cobbed out; and what would today constitute a high grade of millrock was thrown out on the dump with whatever waste accumulated during the operations. Also, the dumps were often placed without any thought of the future, regardless of the geology of the deposits.

During the next twelve years a rapid development of the asbestos industry was witnessed. The mines were operated on a large scale; villages sprang up in the vicinity of the mines; railroad facilities were obtained, and prospectors became busy exploring the surrounding country for new deposits. Thus, in 1885, seven quarries were reported as producing an annual total of about 1,400 tons of asbestos. The prices obtained for the different grades at the mines were: first quality $80 per ton; second quality, $60; third quality, $40, and the lower grade--suitable only for pulp--$10.

From 1885 there was a gradual increase in the prices, especially for the first and second qualities, until in 1890 about $300 was realized for the first quality. This, and other economic features pertaining to the industry, served to give a powerful impetus to the industry. But unfortunately these conditions did not continue long; prices began to drop gradually, the demand slackened, and it was discovered that the prevailing methods of hand extraction were faulty, inadequate and expensive. Under these conditions the industry languished for some time, with a very depressing effect on all except those who would not be discouraged.

Those who remained engaged in the quarries perceived that only one thing could save the industry, namely, a more economic production. Hence they began experimenting, the result being that a process (mechanical concentration) was developed for treating the shorter fibres, which in the past were thrown out on the dump.

As a result of these innovations--which were first attempted on an experimental scale about 1890--and as new demands for this shorter material sprang up, fifteen quarries were sending material to about nineteen mills in 1909. The combined output of these mills and mines of that year was as follows:

	Tons	Value
Crude	3,074	$ 575,510
Fibre	14,776)	
Fibre No. 2.	45,499)	1,709,077

Although the mechanical treatment of the shorter fibres was conducive to more economic production, there existed no organization (until 1921) through which the mine manager and heads of departments could get together to discuss general conditions. This state of affairs, together with many of the present uses for the product not yet evolved, resulted in over-production and a consequent drop in prices. Under the low prices prevailing up to 1916 many asbestos properties were subject to a periodic shutting down and re-opening. The advent of the war was probably one of the greatest factors which stimulated the industry since its infancy. Demand exceeded supply for the first time, and the

year 1920 found asbestos at the height of its demand and the peak of its market value. No. 1 crude brought from $2,000 to as high as $3,000 per ton, and the "sands," which are by-products and practically barren of fibre, brought as high as $15 per ton.

Owing to these high prices the mines worked at full capacity, the result being the inevitable over-production. The close of the war caused a slackening in demand and this, combined with over-production, resulted in a drop of prices for the material. Competition, always very intense among the various companies, accentuated by other factors in the industry, commenced a period of senseless price-cutting. This state of affairs prevailed until near the end of the year 1925, when an amalgamation of the principal asbestos companies and a cooperative arrangement with other operators who are large fabricators in the United States was consummated.

VARIETIES OF ASBESTIFORM MINERALS

Under the term "asbestos" is generally understood minerals, the fibrous, crystalline structure of which, combined with special qualities and characteristic appearance, entirely differentiates them from others. The most important of these is the "chrysotile" variety. Other varieties of lesser importance are known as "crocidolite" and "amosite."

Chrysotile is a fibrous form of serpentine (hydrous magnesium silicate). It occurs in aggregates of fine, crystalline silky fibres which are flexible, offer high resistance to heat and have considerable tensile strength. These fibres usually range in length from less than 1/8 to 2 or 2½ inches, but fibres as long as 5 to 6 inches are sometimes found.

Crocidolite is a soda-iron monoclinic amphibole. It is highly fibrous, like chrysotile, but its fibres have a higher tensile strength, and a much lower resistance to heat. Its colour is a characteristic lavender-blue, and it is thus often called

"blue asbestos" or "Cape Blue." Fibres commonly range in length from less than 1/8 to $1\frac{1}{2}$ inches, and rarely exceed 3 inches.

Amosite is a magnesium silicate rich in iron and found chiefly in South Africa. When amosite contains considerable soda it approaches crocidolite in composition. Amosite is characterized by a well-developed fibrous structure, having fibres of unusual length, 4 to 7 inches. The fibres are flexible, but are harder and harsher and usually have less tensile strength than chrysotile. Acids have little effect on amosite and it withstands heat better than crocidolite.

The following table shows the average composition of the principal types of asbestos:

	Chrysotile	Crocidolite	Amosite
SiO_2	40.49	51.22	49.58
Al_2O_3	1.27		2.25
Fe_2O_3 and FeO	2.53	34.08	39.64
MgO	41.41	2.48	4.79
CaO		0.03	0.53
Na_2O		7.07	
H_2O	14.06	4.50	3.16
MnO_2		0.10	
K_2O			
Total	99.76	99.48	99.95

GEOGRAPHICAL DISTRIBUTION

The commercial value of asbestos depends chiefly on tensile strength, flexibility, fineness of fibre, dehydration temperature and temperature of fusion. The long fibres, $\frac{1}{4}$ inch or more in length, possessing these qualities, are used for spinning and weaving into fabrics, and are by far the most valuable. The short fibres, less than $\frac{1}{4}$ inch in length, are used in the manufacture of asbestos, cement shingles, etc.

Although deposits of asbestiform minerals are widely distributed over the world, there are but few localities in which high-grade spinning fibres are found in important commercial quantities. Before the World War Canada (Quebec) and Russia furnished most of the world's supply of high-grade asbestos. At present Russian production is small

and South Africa (including Rhodesia) is the only other large source besides Canada. The United States has produced some spinning-fibre asbestos (Arizona chrysotile), but most of the domestic production has been of non-spinning anthophyllite. Other countries which are small producers include Australia, Cyprus, Italy, China and India.

Canada - Canada is the largest producer of asbestos in the world (over 80 per cent). Canadian asbestos, which is of the chrysotile or serpentine variety, is of the finest quality, and, on account of its softness, silkiness and tensile strength is in great demand for all kinds of asbestos products, particularly for asbestos textiles.

Apart from deposits in Deloro township, Ontario, which have not as yet assumed commercial importance, all our production comes from the Thetford-Black lake area, situated in the Eastern Townships of Quebec, and notably in the townships of Thetford, Coleraine and Broughton. The total length of this productive serpentine belt is about twenty-three miles, with a width varying from 100 to 6,000 feet in the Black lake area, and to $3\frac{1}{2}$ miles in Coleraine township. The serpentine forms knolls and ridges from a few hundred to a thousand feet in height above the surrounding country. The Broughton and the central and eastern Thetford areas contain mainly slip-fibre deposits, and the belt, which includes Western Thetford, South Ireland and North Coleraine townships, consists chiefly of vein-fibre deposits. The vein-fibre belt produces the highest grade crude and spinning fibre.

The chrysotile veins intersect portions of the serpentine in every direction, but they usually follow straight lines. The cross-fibre veins vary in thickness from mere threads up to 2 or 3 inches, but the bulk of the asbestos is from $\frac{1}{4}$ to $\frac{1}{2}$ inch in length. Slip-fibre occurs along slicken-sided fault planes and the fibre is arranged parallel to the walls in thin films or in layers up to 3/8 inch or more in thickness. The slip-fibre veins yield only mill fibre. It is often of as good a grade as mill fibre prepared from cross-fibre veins, but it is sometimes rather harsh.

The Canadian deposits are very extensive, and the known ore reserves are large.

Union of South Africa - Important deposits of asbestos occur in several localities in the Union of South Africa. The principal varieties of asbestos which have been produced are crocidolite and amosite, but chrysotile is also worked and will probably become of increasing importance.

Transvaal possesses important deposits of chrysotile, crocidolite and amosite.

Amosite is found only in a belt in northwestern Transvaal between Lydenburg and Pietersburg. This belt, which is about 60 miles long by an average of 6 miles wide, contains three groups of deposits, each consisting of several parallel seams, varying in width to a maximum of about 12 inches. The veins are worked by underground mining. The principal mines are the Egnep and Amosa, situated near the farms Penge and Streatham.

The best developed occurrences of chrysotile are east of Carolina in the Diepgezet and ~~Goedverwacht areas,~~ and in the Kaapsche Hoop section of the Barberton district. The Kaapsche Hoop area is being actively exploited by Amianthus, Limited, Munnik-Myburgh Asbestos, Limited, and Kaapsche Hoop Chrysotile, Limited. This is at present the productive source of chrysotile in the Union. At the Sitlo mine in Natal in the Tugela Valley a deposit of chrysotile has been worked at intervals.

Crocidolite was first produced in the Cape Province, but during the last few years additional deposits have been opened up in the northeastern Transvaal. The chief centres of activity in the Cape Province are at Keikamspoort, at Koegas and Westerberg, at Danielskuil and district and around Kuruman. The oldest and most important producer is the Cape Asbestos Company, with headquarters at Koegas. This company recovers asbestos from some eight farms, of which the most important is Westerberg. They are also manufacturers of asbestos goods in Europe.

Rhodesia - Rhodesia is the most important source of asbestos in British South Africa. Both chrysotile and amphibole asbestos occur in many localities in southern Rhodesia. The largest production comes from the Shabani fields in the Belingwe district and from the Mashaba area in the Victoria district. The fibre from the former area varies from 1/8 to 2 inches in length and that from the latter is rarely over $\frac{3}{4}$ inch in length.

Asbestos also occurs, and has been prospected to some extent, in the Lomagundi and Bulawayo districts.

Russia - Before the great war Russia ranked second as a producer of chrysotile asbestos. The largest deposits of Russia are situated in the Ural mountains, where they are found generally in connection with the masses of serpentine rock. There are also many occurrences of asbestos in Siberia and in the Caucasus, but not all of them are of industrial importance.

Russian asbestos which has been exported came principally from the Barkenovo district. Up to 1914 about 95 per cent of the whole asbestos output of Russia came from the deposits of this district, and its importance has not diminished since then. The deposits are situated in the Province of Perm, 90 km. northeast of Sverdlovsk. Further northwest the asbestos belt runs to Reshevsk and thence to the Alapaievsk and Neviansk deposits. South of them asbestos was discovered in the Province of Orenburg.

United States - Both spinning-fibre chrysotile and non-spinning anthophyllite occur in the United States, but the former is not found in large quantities and production, compared to that of Canada, has been very small. Although deposits of asbestos have been reported in many states, production of any importance has only come from the state of Arizona. Small amounts have come at various times from Vermont, Wyoming and California. Anthophyllite has been produced mainly in Georgia, but Idaho, Maryland and California have also been producers.

Cyprus - Deposits of chrysotile asbestos occur on the island of Cyprus which produce annually small amounts of asbestos. Much of the material produced is short-fibred, but some is of a grade that may be mixed with Canadian fibre.

Italy - Italy is a small producer of asbestos, most of which is apparently of the amphibole variety. There are three asbestos districts: in the Susa Valley near Mount Cenis; in the Aosta Valley, and in the Valtellina district of Lombardy, near Sondrio. Italy does not produce sufficient spinning fibre for her own needs, but imports chiefly from Canada and Africa.

Other Countries - Asbestos deposits, of both the chrysotile and amphibole types, are known in many other countries, and from some of them have come small and irregular productions, but none of them are of great present importance. This may be due to various reasons.

Some of the countries in which deposits of asbestos have been worked or have been reported are: Australia, China, Japan, India, Finland, Switzerland, Greece, Turkey, Portugal, Spain, France, Germany, Norway and Great Britain.

USES

The following, according to "Asbestos," July, 1925, is a list of the uses of asbestos and asbestos products, but it should not be taken as complete, as new uses are being found daily for this material:

Raw Material (crudes, fibre and sand)

Yarn
85% magnesia pipe covering, blocks and locomotive lagging,
Compressed sheet packing
Wick packing
Rope packing
Filling of asbestos mattress insulation.
Asbestos cement products, viz.,
shingles,
flat sheathing
corrugated sheathing
water pipes
wall tile
decorative panels
pulleys
chimneys
Boiler plugs
Moulded composition
Insulation of batteries (loose fibre)
Insulation of walls (loose fibre) and floors,
On gas logs
Snow for Christmas trees
Snow used in Movies
Asbestos whiskers (for Santa Claus)
Paper (plain and corrugated)
Millboard
Rollboard
Wallboard
Asbestos cement for insulating boilers, etc.
Waterproofing
Glazing and pointing.

Roofing cement
Furnace cement
High temperature insulation (Prasco)
Plaster - replacing hair
Stucco
Paints, varnishes and fillers
In pottery to keep shape intact until baked.
Matches,
Filter fibres (principally amphibole).
Filter pads in Gooch filters
Wadding in cartridges.
Timing devices in bombs,
Block of asbestos rock for "Dutch" oven in steam generating plant.
Packing for expansion joint in furnace walls.
Paste from which to mould puppets on marionette stage.
In making an asbestos felt for acoustile work.

Uses for asbestos yarn

Cloth,
tape,
Brake lining,
Clutch facing,
Valve stem packing,
Braided packing,
Metallic asbestos gaskets,
Asbestos rope (obsolete--once used for firemen's rope).
As a seating for glass in glazing bars,
For spark plugs,
Electrical insulation,
Tying gas mantles,
Twine,
Sewing asbestos mattresses, theatre curtains, clothing, etc.
Non-frayable edges for stretchless hair belting,
Facing for dryer felt.

Uses of asbestos cloth

Packings
Sheet packing
High pressure, folded or wound,
Brake lining,
Clutch facing,
Gaskets,
Clothing, viz.;
gloves and mittens,
helmets,
aprons,
leggings,
suits,
Mail bags,
In acoustile treatment,
Filtering,
In acetylene welding,
Theatre curtains,
Portable motion picture booths,
Rugs,
Floor lining in theatres,
Theatre scenery,
Gun grips,
Tapestry (European),
Asbestos blankets for use in electrolyzer cells,
Also bags and diaphragms for same purpose in oxygen producing plants,
Asbestos-faced wipers in commutators,
Asbestos mattresses (for insulation).
Clothing for puppets on marionette stage,
Lining for wooden boxes in which to raise meal worms for Japanese nightingales.
Asbestos blanket for smothering fires.
In laundries on mangles,
Protectors for gas bags in balloons,
Insulation in ovens,
Padding in prison cells,
Lining of footboard of automobiles to decrease heat,

Uses of asbestos tape (woven from yarn.

Pull strings to pull pans from large ovens,
Insulating locomotive steam pipes at bends, etc.
Winding coils,
Insulating armatures,
Winding buss bars,
Insulating underground cables,
Laboratory uses, viz:
Insulation of flasks, test tubes, retorts,
Tie straps in diffusing materials,
In glass manufacture for wrapping tines of forks to take bottles from ovens,
Reinforcing paddles for stirring molten glass.
Protection of glass bowls on train lighting system.

Uses of Wick Packing

As packing,
For wiping wire or armor plate,

Uses of Asbestos Composition Material.

Phonograph records,
Buttons,
Electric wire insulation,
Heater cord insulation,
Insulation compounds,
Condensite celoron for gears,
Sealing of percussion caps in large cells,
Lamp sockets,
Rheostat backings,
Switch parts,
Arc deflectors,
Mountings for heating elements,
Resistance mountings,
Radiator caps for automobiles,
Imitation marble (European),
Porous filler in acetylene composed of asbestos, charcoal, kieselguhr and cement.
Composition of soapstone and asbestos used for body of electric stove.
Pipe heel,
Underground insulation (undasbestos)
Flooring composition.

Uses of Asbestos Paper

Air cell and other coverings made of asbestos paper.
Asbestos felt roofing,
Asbestos built-up roofs,
Asbestos protected metal roofing,
Many electrical and heat insulations in various ways and in various places, for instance, the electric percolator, toaster, grill, iron and other heating devices are lined with asbestos to prevent the escape of heat.
Tubes in electrical industry,
Filing cabinet lining,
Filtration purposes,
Baking sheets,
Lining table pads,
Table mats,
Lining of stoves and heaters,
Insulation of ovens and dry kilns,
Inner casing in pipeless heaters,
Gaskets,
Asbestos metallic gaskets,
Discs and linings in cartridges and other explosives,
In acetylene welding to protect from extreme heat,
In chemistry and physics in many and various ways,
Wicks in oil stoves,
Lining of soldiers' helmets,
Annealing (crumbled paper),
In burning carbon deposits in autocylinders to protect exposed parts,
Soldering pads,
Baking sheets,
Lining of mufflers of automobiles,
Lining drum controllers in sulphite mills,
Lining auto radiator covers,
Insulation (with magnesia) in ovens
Around soldering iron just above tip,

Uses of Asbestos Millboard

Lining of stoves and heaters,
Fireproof wallboard,
Asbestos table pads and mats,
Lining of safes and insulation of ovens and dry kilns,
Stove mats,
Fire protection of ceiling over boilers and smoke stacks,
In metal-clad doors, the millboard being placed on both sides of the wood, underneath the sheet of metal,
In copper gaskets,
Glass mills cover their paddles with it, the paddles being used to take out the bottles from the furnaces,
Lining of garages and moving picture booths,
Lining of electric switch boxes,
In gas range ovens, $\frac{1}{4}$" in bottom prevents burning of pies, cakes, etc.
Washers in electric irons,
Guards for stoves and ovens in restaurants,
Lining for dry cleaning machines to protect from fire in using gasoline spray,
Tent shields and stove pipe rings,
Lining garbage incinerators,
Lining for hoods of automobiles.

Uses of Asbestos Flat Sheathing (lumber)

Insulators between phases and on arc deflectors,
Manufacture of cabinets and panel box work,
Switch boards,
Prevention short circuits in trolley cars,
Laboratory table tops,
Exterior sheathing (half-timber effect) on houses or other buildings,
Interior sheathing of factories, etc.
Portable houses or school buildings, traffic police shelters, etc.
Semi-portable motion picture booths,
Mounting of test instruments and gauges in sulphite mills.

PRODUCTION AND CONSUMPTION

The World - The production of asbestos in the principal asbestos producing countries in the world is shown in the following table:

World's Production of Asbestos. Calendar Years (1)

Metric tons

Country	1913	1919	1923	1924	1925	
Canada	118,361	136,669	206,680	201,557	232,143	(b)
Southern Rhodesia	259	8,744	18,132	23,340 (c)	13,018	(6 mos.)
Union of South Africa	859	3,582	7,488	6,465 (c)	4,085	(c)
Australia		1,790	319	X	X	
China		68	X	X	X	
Cyprus	1,168	1,331	1,556	3,917 (d)	X	
India		388	X	X	X	
Italy	172	96	X	1,210 (a)	X	
Russia	17,218	4,032	5,400 (a)	8,100 (a)	10,000 (e)	
United States	982	1,036	277	268 (d)	X	

(a) Engineering and Mining Journal, April 25/25.
(b) ~~Estimated~~ Dominion Bureau of Statistics.
(c) South African Journal of Industries.
(d) "Asbestos".
(e) (Fiscal year, Oct.1924-Sept.1925) - Engineering and Mining Jr. Press, Jan.23/26.
(1) Dominion Bureau of Statistics.
X Data not available.

Canada - It will be noted from this table that Canada is by far the largest producer of asbestos. The figures given, however, are somewhat misleading, in that much of the Canadian production is of the lower grades of mill fibre, paper stocks, paper fillers, etc., while most of the asbestos produced in Rhodesia and in the Union of South Africa is of high-grade spinning fibre. The local consumption of asbestos in these latter countries is very small and hence there is little local demand for the lower grades of fibre. These lower grades command too low a price to justify the expense of transportation for long distances. The distribution of Canadian (Quebec) production by grades in 1924 is shown in the following table:

Sales of Asbestos in Canada for the year 1924.

Classification	Quantity Tons	Sold or Shipped Total Sales Value at mill	Average value per ton
Crude No. 1	866	$316,886	$365.92
Crude No. 2	3,546	720,291	203.13
Fiberized Crude	71	12,080	170.14
Spinning stocks	10,082	1,096,864	108.79
Shingle stocks	19,022	893,575	46.98
Mill board stocks	11,753	355,772	30.27
Paper stocks	58,623	1,854,260	31.63
Paper fillers	60,047	895,784	14.92
By-Products (asbestos sand, etc.)	55,823	352,839	6.32
Total	219,833	$6,498,351	$29.56
Ontario	172	91,900	....
Grand total	220,005	$6,590,251	$29.95

Canada although producing over 80 per cent of the world's production, imports manufactures of asbestos valued at about half a million dollars yearly, which would appear to show that the manufacturing end of the asbestos industry can be much further developed in the Dominion. In this connection it is interesting to note that the manufacturing plant of the Canadian Johns-Manville at Asbestos (Quebec) was put in operation in June, 1924. The company manufactures asbestos paper and mill board; asbestos roofing of all kinds; asbestos shingles; asbestos building materials; asbestos cellular, and sponge felted pipe insulations; insulating sheets and blocks; asbestos brake linings and clutch facings are woven on special looms, necessary for making asbestos textiles; asbestos packings for steam, oil and hydraulic operations. Asbestos-cement shingles and other products are made at Lachine, Que., by the Asbestos Manufacturing Co. Ltd. and a plant is operated at East Broughton, Que., by Asbestonos Ltd., to thread, spool and weave asbestos fibre.

The following is a list of mine operators in the Quebec area for 1924:

Asbestos Corporation of Canada Ltd., Thetford Mines, Que.
Asbestos Mines Ltd., East Broughton, Que.
Bennett-Martin Asbestos and Chrome Mines, Ltd., Thetford Mines, Que.
Black Lake Asbestos & Chrome Co. Ltd., Black Lake, Que.
Canada Asbestos and Chrome Co., Black Lake, Que.
Consolidated Asbestos, Ltd., Thetford Mines, Que.
Federal Asbestos Co., Robertsonville, Que.
Johnson's Company, Thetford Mines, Que.
Keasbey & Mattison, Thetford Mines, Que.
Maple Leaf Asbestos Corporation Ltd., Thetford Mines, Que.
Pennington Asbestos Co., Thetford Mines, Que.
Quebec Asbestos Corporation, East Broughton, Que.
Canadian Johns-Manville Company, Ltd., Thetford Mines, Que.

Union of South Africa and Rhodesia

The increased demand for asbestos during the war period, and the many new uses to which the fibre is now being applied, together with the elimination for a time of Russian supplies, have helped to develop the South African and Rhodesian deposits. Great progress has been made in the asbestos industry and mine owners are preparing further to extend operations. The industry in these countries is on a sound basis and for many purposes the crocidolite fibre produced there competes favourably with the Canadian fibre, except in No. 1 crude, which is a Canadian specialty.

A start has been made in establishing industries for the production of asbestos-cement products. A small number of companies have recently begun operations, turning out a variety of concrete and asbestos-cement products, the main product being asbestos-cement sheets. Owing to the pressure of competition with oversea producers (principally Great Britain, Belgium, Holland and the United States), the operating companies are forced to produce on the basis of a restricted output, though capable of producing all the requirements of the Union in the general run of asbestos-cement products.

Russia

Prior to the war Russia produced over 12 per cent of the world's production of asbestos. At the outbreak of hostilities the output gradually decreased, and this slackening in production was further accentuated by the civil revolution. It was not until the end of 1919, however, that measures could be adopted for the enlarging of production. Since 1920 production has gradually increased, and about 50 per cent of the output of pre-war times has now (1925) been obtained.

Before the war the manufacture of asbestos products was carried on by factories at Riga, Moscow, Leningrad, Briansk, Baku, Lublin, and other places, as well as by both of the Ural Mines' factories. The latter two establishments have been reconstructed to enlarge production, the one being destined for 6,000 poods (36.11 lbs. equal 1 pood) of textures, ropes and wick packing, and the other for 60,000 poods of asbestos millboard.

According to the Engineering Mining Journal-Press of January 23, 1926, not only has the whole production of the last twelve months (Oct. 1 - Sept. 30.) been sold, but a large portion of the stock on hand has been consumed. This is particularly due to the greater demand for asbestos goods in Russia herself. While the higher grades of raw asbestos, as was the case previously, are exported, the lower grade material is now as far as possible utilized for domestic industry, especially for roofing and fireproof materials.

Italy

Italian asbestos is known because of its chemical resistant qualities. Due to the difficulty in quarrying and transportation the yield of the mines has never been important commercially.

United States

The United States is the largest consumer of high grade asbestos in the world and the largest manufacturer of asbestos goods. The amount of raw asbestos consumed by the United States annually exceeds the combined consumption of all other countries of the world, and of the total world's output of the raw product it produces only about 1 per cent. Imports of the raw material come chiefly from Canada, but South African asbestos is being used in important and increasing amounts.

Great Britain

Great Britain produces practically no asbestos, but is the second largest manufacturer of asbestos products. Raw asbestos is imported chiefly from South Africa and Canada.

IMPORTS AND EXPORTS

England

Imports of asbestos into England for the years 1922 and 1923.

	1922		1923	
	Tons	Value £	Tons	Value £
Asbestos, raw and fibre -				
Portuguese East Africa	8,525	311,208	457	14,550
United States.....	108	2,020	302	7,703
Other foreign countries	379	8,317	278	4,302
Cape of Good Hope.....	3,815	144,972	3,685	120,806
Natal.....	457	19,192	536	17,529
Rhodesia.....	2,233	96,700	9,235	293,944
Australia	108	6,109	348	12,430
Canada	2,404	76,848	3,244	52,312
Other British possessions	124	4,365	150	5,311
Total.....	18,153	669,731	18,235	528,887
Asbestos waste, including asbestic -				
Total from foreign countries..	352	3,205	507	3,734
Total from British possessions....	86	708	606	6,631
Total.....	438	3,913	1,113	10,365
Asbestos manufactures -				
Norway.....			1	20
Netherlands.....	269	4,621	1,066	10,742
Belgium.....	6,311	75,508	10,521	103,659
France.....	215	17,713	121	16,925
Italy.....	348	12,173	748	30,870
United States	76	21,339	375	26,202
Other foreign countries	334	12,171	190	14,021
Canada	...	...	17	510
Other British possessions	...	...	1	126
Total	7,553	143,525	13,040	203,075

Imports of raw asbestos into England for the year 1924

	Tons	Value
From Rhodesia.....	11,026	£347,962
" Canada	8,473	117,010
" other countries..	3,728	89,909
Total.....	23,227	£554,881
Re-exports	5,868	188,671

Exports of raw and manufactured Asbestos from England for the years 1922 and 1923

	1922		1923	
	Tons	Value £	Tons	Value £
Asbestos, raw and fibre -				
Foreign countries	80	2,811	100	2,873
British possessions....	8	369	4	343
Total.....	88	3,180	104	3,216
Asbestos waste, including asbestic -				
Foreign countries.....	2	55	8	146
British possessions....	1	19	.	...
Total	3	74	8	146
Asbestos manufactures -				
Sweden.....	262	22,110	380	28,526
Norway	87	21,009	163	21,555
Denmark	117	14,087	160	13,133
Netherlands	288	31,608	430	39,264
Belgium	340	33,651	342	40,741
France	243	87,293	366	111,466
Spain	273	28,809	232	29,091
Italy	106	10,953	100	13,769
Persia	542	20,413	338	11,100
China	638	35,381	338	20,125
Japan	207	27,054	372	27,468
United States	100	22,552	105	32,017
Mexico	123	3,885	192	5,428
Chile	47	7,178	122	10,754
Brazil	134	13,434	87	11,090
Argentine Republic	149	18,964	313	24,366
Irish Free State	...	657	...	14,893
Egypt	133	9,702	...	...
Gold Coast	115	3,965	434	8,235
Nigeria	726	21,020	595	11,715
Cape of Good Hope.....	246	15,578	174	7,849
Natal	286	10,614	212	13,338
Transvaal.....	97	8,240	93	7,599
Mauritius & Dependencies	117	3,290	35	1,425
British India	1,505	101,559	1,415	89,627
Straits Settlements....	110	9,760	202	15,178
Hong Kong	381	17,607	155	10,025
Australia	257	33,896	680	51,808
New Zealand	618	20,033	1,226	33,411
Canada	275	27,256	105	19,095
Other British possessions	456	18,714	1,392	31,133
Other foreign countries	622	62,414	1,124	75,923
Total.....	9,600	762,009	12,589	831,165

Re-exports of Asbestos from England for the years 1922 and 1923

	1922		1923	
	Quantity Tons	Value £	Quantity Tons	Value £
Asbestos, raw and fibre -				
Germany.....	2,800	111,392	1,594	54,228
Netherlands.....	120	5,581	88	4,313
Belgium	1,620	49,132	2,463	76,253
France.....	2,222	88,554	1,951	70,486
Spain.....	846	21,704	174	5,055
Italy	246	10,741	465	18,704
United States	927	53,484	1,525	82,064
Other foreign countries..	25	844	95	2,695
Total British possessions	7	362	9	360
Total.....	8,813	341,794	8,364	314,156

Continued -

	1922 Quantity Tons	1922 Value £	1923 Quantity Tons	1923 Value £
Asbestos waste, including asbestic -				
Foreign countries.....	31	518	163	1,897
British possessions	..	12	4	63
Total.....	31	530	167	1,960
Asbestos manufactures -				
Foreign countries	143	4,634	76	2,790
British possessions.....	16	743	129	3,031
Total	159	5,377	205	5,821

Exports of Manufactured Asbestos for 1924

	Quantity Tons	Value £
To Netherlands.....	429	46,260
" France	556	149,538
" United States	107	24,974
" British India	1,439	86,630
" Other countries.....	11,425	649,448
Total	13,956	956,850

Canada

Imports of Asbestos into Canada by Countries for the years 1923, 1924 and 1925.

	1923 Quantity lbs.	1923 Value $	1924 Quantity lbs.	1924 Value $	1925* Quantity lbs.	1925* Value $
Asbestos packing -						
Great Britain	36,703	17,992	36,587	18,208	34,591	17,748
United States	120,640	56,544	184,501	80,093	152,492	62,448
Other countries	10,335	3,473	178	117	...	...
Asbestos in any form other than crude, and all manufactures of n.o.p. -						
Great Britain	...	50,321	...	38,894	...	38,071
United States	...	646,646	...	399,526	...	209,605
Other countries	...	352	...	2,880	...	4,051
Total		$775,328		$539,718		$332,023

* Nine months.

Exports of Canadian Asbestos by Countries of destination for the years 1923, 1924 and 1925.

	1923		1924		1925*	
	Quantity Tons	Value $	Quantity Tons	Value $	Quantity Tons	Value $
Asbestos -						
United Kingdom	3,459	215,934	6,614	374,680	5,154	458,214
United States	109,025	5,596,569	72,233	3,904,161	68,975	3,637,476
Australia.....	180	9,900	473	24,130	830	60,132
Austria.....	400	30,000	...	...	...	...
Belgium.....	7,223	411,250	2,798	150,055	4,469	278,600
Denmark.....	110	7,700	...	...	100	5,500
France.....	5,016	409,410	5,640	652,151	4,251	334,475
Germany.....	6,289	575,211	9,133	785,703	6,683	538,407
Italy	505	52,882	2,439	151,778	2,989	202,753
Japan	4,936	287,521	9,222	358,596	5,717	303,405
Netherlands...	353	28,275	1,068	86,580	2,191	184,110
Other countries	55	4,125	110	7,975	130	7,800
Asbestos sand and waste -						
United Kingdom	1,174	18,925	3,100	53,983	1,461	26,946
United States	75,540	892,360	89,582	1,123,231	80,269	1,034,964
Other countries	1,237	19,960	2,337	42,056	2,374	42,835
Asbestos manufactures including asbestos roofing -						
United Kingdom..		2,054		1,007		234
United States...		61,160		30,272		26,487
France.....		2,631		32		128
Newfoundland....		4,472		7,066		3,577
Other countries		2,181		5,755		11,464
Total Asbestos						
United Kingdom..		236,913		[illegible]		[illegible]
United States...		6,550,089		5,057,664		4,698,927
Other countries.		1,845,518		2,073,887		1,977,276
Total.....		$8,632,520		$7,561,221		$7,161,597

United States

Imports of Asbestos for consumption into United States by grades for the years 1923 and 1924.

Grades	Unit of quantity	1923 Quantity	1923 Value $	1924 Quantity	1924 Value $
Unmanufactured	ton				
Crude.....	"	25,491	2,602,906	13,728	1,794,018
Mill fibre....	"	86,490	3,872,271	66,293	2,654,201
Stucco.....	"	84	2,467	30	450
Other (refuse, sand, etc.)	"	77,596	967,499	83,565	1,154,276
Manufactures wholly or chiefly of asbestos:					
Yarn.....	pound	10,957	8,596	5,470	5,347
Fabrics, woven...	"	97,695	52,771	70,528	28,110
Packing, fabric..	"	5,713	2,798	10,669	4,682
Packing, not fabric,	"	24,021	10,063	30,372	8,692
Paper & mill boards	"	272	136	243,822	9,500
Shingles, slate, wood or lumber	"	11,970,649	223,948	17,877,722	292,149
Asbestos cement	"	... ...	... ...	194,005	3,080
Other manufactures	"	2,927,000	122,278	2,422,728	119,059

* Nine months.

Imports of Asbestos into United States by Countries
for the years 1923 and 1924.

Country	1923 Unmanufactured Quantity Tons	1923 Unmanufactured Value $	1923 Manufactured Quantity lbs.	1923 Manufactured Value $	1924 Unmanufactured Quantity Tons	1924 Unmanufactured Value $	1924 Manufactured Quantity lbs.	1924 Manufactured Value $
Austria.....			45,591	15,777			55,009	12,704
Belgium.....			13,573,486	240,530	5	132	19,909,275	335,266
France.....		47	64,972	4,093			75,980	5,628
Germany.....	132	32,376	454,590	11,160	50	5,329	448,049	17,758
Greece.....					80	8,720		
Italy.....		59	25,459	551	2	367	137,477	1,860
Netherlands....	1	369	13,645	1,011	2	92	502,167	13,736
England.....	1,571	376,306	171,892	81,163	372	67,201	202,113	59,649
Scotland.....							1,013	259
Canada.....	185,945	6,688,142	657,770	37,732	160,760	5,156,901	673,671	23,402
British South Africa	250	33,273			929	100,194		
Portuguese East Africa	1,636	288,314			937	181,549		
Other Portuguese Africa	109	24,888			479	82,439		
Sweden.....							5	24
Other countries		1,369	4,716	3,480				
Total	189,661	7,445,143	15,068,546	417,684	163,616	5,602,945	22,004,759	500,306

Exports of Asbestos from United States by Articles for the years 1923 and 1924.

	Unit of Quantity	1923 Quantity	1923 Value $	1924 Quantity	1924 Value $
Unmanufactured asbestos.....	tons	607	48,525	1,134	93,163
Paper, millboard and roll board	lbs.	3,559,898	190,755	2,171,674	124,228
Pipe covering and cement.....	"	5,667,731	426,085	4,848,030	288,266
Textiles,yarn and packing.....	"	1,037,786	672,488	1,197,508	788,361
Other manufactures of asbestos except roofing		3,249,762	800,623	2,728,741	787,461
Asbestos roofing	squares	104,445	423,392	48,968	297,900

Exports of raw and manufactured Asbestos from United States for the Year 1923

Exported to:	Asbestos unmanufactured		Paper, millboard and rollboard		Pipe covering and cement		Textiles, yarn and packing		Other manufactures except roofing		Asbestos roofing	
	tons	$	lbs.	$	lbs.	$	lbs.	$	lbs.	$	squares	$
Austria												
Belgium					1,070	482	2,029	1,350	10,024	7,977		
Denmark.....					840	300	19,810	16,951	11,756	6,197		
France.....	109	3,872	99,010	13,666			8,756	6,740	189,553	99,682	649	1,083
Germany.....	7	1,515					2,129	1,582	10,849	6,647		
Italy.....	27	3,563			280	20	3,249	2,794	29,443	21,275		
Sweden.....					3,966	309	13,889	11,818	29,367	22,629	122	484
England.....	129	22,445	86,431	6,942	7,802	558	51,677	50,207	289,451	58,254	4,282	8,695
Canada.....	85	1,680	2,891,562	130,701	3,135,238	244,135	286,683	149,233	1,104,474	177,248	11,368	36,876
Mexico.....	12	798	79,018	5,859	786,817	49,264	127,484	63,027	479,649	58,886	29,814	74,743
British West Indies	1	69	2,558	356	40,574	3,702	10,998	8,909	15,111	5,318	1,121	4,154
Cuba.....	4	228	56,292	2,703	713,034	49,384	159,597	86,021	198,266	37,787	20,543	156,627
Argentina.....			39,715	2,808	88,145	8,140	10,290	6,970	17,356	14,225	2,425	3,641
Brazil.....			4,922	225	82,905	5,333	14,653	10,816	45,355	16,401	1,044	1,717
Chile.....			25,221	2,892	84,816	5,009	18,757	15,109	43,864	24,948	1,920	4,216
Peru.....			3,026	200	13,117	2,234	12,644	5,970	4,880	2,265	230	588
China.....			22,561	1,376	111,606	15,386	17,802	9,783	47,043	8,173	744	2,479
Japan.....	224	12,984	48,319	3,733	67,967	5,345	73,837	68,201	54,054	18,518	8,150	46,555
Philippine islands			42,676	1,406	149,057	5,250	32,547	26,140	17,218	9,316	200	640
Australia.....	1	475	11,829	2,301	3,307	666	30,991	28,395	111,336	57,628	32	500
New Zealand.....	2	482	24,136	3,654	1,959	450	5,208	4,396	64,200	26,644	234	1,510
British South Africa			4,088	700	4,537	651	7,157	6,901	30,188	19,011	2,462	4,462
Other countries	6	414	118,484	11,233	370,594	29,467	127,569	91,195	446,525	101,594	19,105	74,422
Total.....	607	48,525	3,559,848	190,755	5,667,731	426,085	1,037,756	672,488	3,249,762	800,623	104,445	423,392

Exports of raw and manufactured Asbestos from United States for the Year 1924.

Exported to:	Asbestos unmanufactured tons	$	Paper, millboard and rollboard lbs.	$	Pipe covering and cement lbs.	$	Textiles, yarn and packing Lbs.	$	Other manufactures except roofing lbs.	$	Asbestos roofing squares	$
Austria.....	179	21,750										
Belgium.....					799	180	4,048	2,549	15,175	11,279		
Denmark.....			18,810	1,030			43,707	19,694	49,439	13,797		
France.....	267	25,170	21,260	6,727	1,840	229	27,402	20,656	174,265	95,551		
Germany.....	9	605					1,910	1,211	7,077	4,525		
Italy.....			352	27			25,337	16,752	47,816	32,996		
Sweden.....			258	84	3,600	364	16,231	17,840	24,090	14,521		
England.....	61	1,906	53,618	2,775	43,698	1,958	25,432	24,079	378,697	53,659	1,268	4,565
Canada.....	31	1,919	1,494,696	77,401	1,276,637	94,017	286,408	145,461	916,429	158,388	1,336	9,207
British West Indies	2	56	44,222	1,688	32,012	2,277	15,066	11,398	7,624	2,773	255	1,360
Mexico.....	4	154	103,367	6,438	914,147	53,138	216,099	154,957	332,303	57,091	12,314	48,553
Cuba.....	5	241	118,043	4,047	690,843	38,410	125,322	73,163	75,391	34,817	15,537	115,352
Argentina.....			3,012	178	90,352	6,436	12,300	6,746	47,284	32,187		
Brazil.....	31	7,929	8,516	728	58,919	3,943	18,635	12,122	53,872	27,464		
Chile.....			25,501	3,049	44,991	2,708	15,756	11,366	59,087	20,993	2,656	8,983
Peru.....			3,069	248	54,282	4,655	7,425	5,151	58,781	4,767		
China.....			2,800	258	131,591	11,137	10,595	8,448	24,327	6,651		
Japan.....	458	21,360	101,561	7,528	18,941	969	101,764	78,444	29,065	20,783	2,526	26,583
Philippine Islands			8,417	518	142,806	7,434	66,223	47,845	27,302	18,678		
Australia.....	33	810	4,559	1,311	12,193	1,238	34,915	27,420	101,428	56,393		
New Zealand.....			625	35	3,696	139	4,000	3,221	48,390	16,167		
British South Africa			2,220	375	4,012	620	5,782	4,811	25,675	10,904		
Other countries...	54	11,263	156,768	9,783	1,222,651	58,414	133,151	95,027	226,224	90,077	13,076	83,297
Grand total.....	1,134	93,163	2,171,674	124,228	4,848,030	268,266	1,197,508	788,361	2,728,741	787,461	48,968	297,900

Re-exports of Asbestos from United States for the years 1923 and 1924.

Exported to:	1923 Unmanufactured Tons	1923 Unmanufactured Value $	1923 Manufactured Lbs.	1923 Manufactured Value $	1924 Unmanufactured Tons	1924 Unmanufactured Value $	1924 Manufactured Lbs.	1924 Manufactured Value $
Belgium.....	9	2,000			3	320	400	20
Germany.....	64	13,695			314	35,636		
France.....	47	1,070						
Italy.....	7	2,300			70	4,500		
England.....	4	600			7	2,254	76	65
Japan.....	10	900	2,311	878	57	2,116		
Canada.....			586	222			138	56
Mexico.....			1,430	80	18	1,456		
Netherlands.....					71	6,100		
Spain.....					18	2,000		
Cuba.....							419	367
Total.....	141	29,565	4,327	1,180	558	54,376	1,053	508

Rhodesia -

Value of Exports of Asbestos from Southern Rhodesia for the years 1923 and 1924.

1923	1924
£	£
469,026	498,855

Union of South Africa -

Value of Exports of Asbestos from Union of South Africa for the years 1922 and 1923.

Countries	1922 £	1923 £
England.....	89,158	98,940
Germany.....	19,384	21,792
Holland.....	4,442	2,016
Australia.....	28,479	38,233
Other countries.	19,026	13,836
Total exports.	160,469	174,817

Germany

Imports into Germany (Hamburg) of raw Asbestos during 1924; also a summary of imports for seven different years.

	1924	
From Canada.....	187,249 bags	
" United States.....	8,830 "	
" England.....	13,260 "	
" Africa.....	44,088 "	
" Holland and Belgium	3,552 "	
" Russia (Leningrad, Riga)	63,692 "	plus 326 tons
" Various ports	1,201 "	
Total.....	321,852 bags	plus 326 tons.

Summary for Seven Years

Years	Tons
1913	16,088
1919	1,188
1920	5,143
1921	6,861
1922	13,995
1923	16,725
1924	21,798

Cyprus

Exports of Asbestos from Cyprus for the Year 1924.

	Tons (2000 lbs.)	Value £
Austria...	500	10,000
Belgium.....	1,358	23,192
England.....	492	6,448
France.....	438	6,665
Germany.....	168	2,869
Holland.....	90	720
Italy.....	1,003	18,407
Spain.....	252	3,089
Switzerland.....	15	300
Other countries....	41	458
Total.....	4,357	72,128

TARIFFS

Canada -

Asbestos in any form other than crude, and all manufactures thereof:

British Preferential tariff	Intermediate tariff	General tariff
15%	22½%	25%

United States

Asbestos unmanufactured, fibres, stucco and sand containing not more than 15 per cent of foreign matter..... Free.
Manufactures of yarn, fabrics and packing composed wholly or chiefly of asbestos..... 30 per cent ad valorem.
All other manufactures of asbestos..... 25 per cent ad valorem.

In the past the Quebec provincial government collected a royalty of 2½ per cent on the gross value of all asbestos mined in the province. Asbestos producers considered this tax very unsatisfactory as many of the mines were not making any profit and had to pay their taxes out of capital.

This tax has been rescinded and the amended Act provides the following duties with respect to the asbestos mines:

(a) Upon annual profits up to $500,000 ..... 3 per cent
(b) On the excess above $500,000 up to 1,000,000 5 " "
(c) On the excess above $1,000,000 ..... 8 " "

MARKETS AND PRICES

No one city has the asbestos market. In pre-war days it might have been said that New York was the American market, and Hamburg the European market for the mineral, but the war shut off the industry's two largest customers, Germany and Austria, and New York obtained the lead. Today most of the selling is done direct. Though there is always a market in New York, many of the larger Canadian corporations do not even maintain an office there, but ship direct to the States, England, Holland, Belgium and France. Much of the South African and Rhodesian asbestos is marketed in London.

Canada

Prices on all grades of asbestos increased greatly during and after the war, reaching a peak in 1921. After the peak prices began to fall rapidly until near the end of last year (1925), when values increased on account, no doubt, of the proposed merger.

According to the Engineering and Mining Journal-Press of January 9, 1926, the prices of asbestos f.o.b., Quebec mines, tax and bags included per ton, were quoted as follows:

Crude No. 1.	$500-525	Shingle stock	$75
Crude No. 2.	$300-325	Paper stock	$40-45
Spinning fibres	$175-200	Cement stock	$25
Magnesia and compressed sheet fibres	$125	Short fibres	$12.50-$17.50
		Floats.....	$15

No. 1 Rhodesian, crude, $325; No. 2, $250 per ton c.i.f. New York.

Russia

Before the war the Ural asbestos was almost exclusively sent to European countries, about 65 per cent of the tonnage being conveyed to Austria-Hungary and Germany. In 1914, 1915, 1916 and 1917 England was the principal buyer. In the following three years (1918, 1919, 1920), no Russian asbestos was exported. Since 1921 the exported asbestos was carried almost exclusively to Hamburg and from this port it has been distributed to different countries,

chiefly Germany, Austria, Belgium, Holland and Italy. Only one shipment, of about 1,500 tons, was sent to London and some smaller loads went to Latvia, Esthonia, Finland and the United States.

The following table gives an idea of the average wholesale export prices of the Russian asbestos before and after the war:

Average export price for Ural Asbestos
(in pounds sterling per metric ton c.i.f., European port)

Grades	1913-14	1920	1921	1923	1924	1925
I.	32-35	180-220	160-100	65-55	55-48	50-60
II.	24-26	150-170	100- 60	43-38	39-36	39-42
III.	18-20	70- 90	55- 35	33-32	32-33	32-34
IV.	12-16	30- 40	30- 32	20-19	19-21	20-22

SPECIFICATIONS, GRADES AND TESTS

Since for most important commercial uses strong, flexible fibre is needed, the brittle anthophyllite type of asbestos needs little mention here. The chief exception is that of filter fibre asbestos. For this purpose a fairly strong fibre is needed and the asbestos must be of such chemical composition that it is practically unaffected by common acids and alkalies.

Some of the physical properties which good asbestos fibres must possess for various uses are as follows: good fibre length, good flexibility, fine fibres, silkiness, high tensile strength, resistance to acids and alkalies, resistance to sea-water and moist air, high melting point, reistance to heat, high heat-insulating value, high electrical-insulating value, good "spinnability." There are now so many and much diversified uses of asbestos that not all of these properties are necessary for any single use. Thus, short fibres may be used for asbestos-paper and asbestos-cement shingles, and long fibres are needed for asbestos textiles. For some purposes two or more types of asbestos with different physical properties (for example, crocidolite and chrysotile) may be mixed advantageously.

A comparison of some of the physical properties of the most important varieties of asbestos is given in the following table:

Comparison of properties of chrysotile, crocidolite and amosite (1).

Property	Chrysotile	Crocidolite	Amosite
Fibre length (usual maximum)....	$1\frac{1}{2}$ to 2 ins.	$1\frac{1}{2}$ to 3 ins.	7 ins.
Tensile strength.....	high	higher than chrysotile	good
Flexibility.....	high	high	good
Fineness of fibre.....	very fine	fine	fine
Resistance to heat.....	good, but becomes brittle	poor, fuses to a glass	good, but becomes brittle
Resistance to acids, alkalies and sea-water	poor	good	good
Electrical-insulating value.....	fair to good	good	
Heat-insulating value..	good	good for moderate heat	good
Spinnability.....	excellent	fair	fair

(1) The properties noted above apply to best grades of each type. (Authorities: Cirkel and Hall).

Canada -

For spinning purposes, Canadian chrysotile is considered the best in the world. Crocidolite is not in high favor in the United States because it is rather difficult to fiberize properly; it is rather dirty and dusty compared with Canadian chrysotile and its fusion point is low. Crocidolite and amosite, usually mixed with some chrysotile, however, are used much more extensively in England and Europe. Amosite fibre is harsher than chrysotile and is rather dirty and dusty to handle. It has been used but little in the United States.

The grading of asbestos for market varies in different districts and at different plants. In Canada there are two main grades, crude and fibre, each of which are divided into sub-grades, in each case based on length of fibre. Crude, produced entirely by hand picking and cobbing, consists of all cross-fibre asbestos 3/8 inch long. No. 1 crude consists of fibre over $\frac{3}{4}$ inch long, and No. 2 crude consists of fibre from 3/8 to $\frac{3}{4}$ inch long.

Mill-fibre grades have not been well standardized. They are based on screen tests but different producers use different classifications. Screen tests are made in a standard testing machine, which consists of four trays, 24 by 14 by 4 inches. The top, or No. 1 tray is fitted with a screen bottom of 2 mesh (No. 11 wire); No. 2 screen is 4 mesh (No. 17 wire); No. 3 screen is 10 mesh (No. 18 wire), and the bottom tray is a solid pan. The nest of screens is fastened to a frame so arranged that it may be vibrated horizontally with a $1\frac{1}{2}$ inch throw by an eccentric revolving at 300 revolutions per minute. In making a test, 1 pound (16 ounces) of fibre is placed in the top tray and shaken for exactly two minutes. The residue in each screen and on the bottom pan is weighed separately and the weight recorded in ounces. Thus, a fibre testing 0-8-6-2 (total 16 ounces) is one of which 8 ounces is retained on the second screen, 6 ounces on the third and 2 ounces of shorts in the pan.

According to the Engineering and Mining Journal-Press, August 12, 1922, the following fibre tests may be taken as averages:

Long-spinning fibre.....	2-8-4-2
Medium-spinning and compressed sheet fibre....	0-8-6-2
Pipe-covering fibres.....	0-5-8-3
Shingle stocks.....	$0-1\frac{1}{2}-9\frac{1}{2}-5$
Paper and millboard stocks	0-0-10-6
Cement stocks.....	0-0-5-11

Shorts are sold according to color and cleanliness.

Asbestic is finely-ground asbestos sand mill tailings

South Africa

There is no uniformity of practice among the South African producers as to grades, but the average seems to range about as follows:

Grade	Length of fibre
D.	over $1\frac{3}{4}$ to 2 inches,
C.	$1\frac{1}{4}$ to $1\frac{3}{4}$ or 2 inches,
B.	$\frac{3}{4}$ to $1\frac{1}{2}$ inches,
A.	3/8 to $\frac{3}{4}$ inches,
S.	up to 3/8 inch.

Russia

The following grading is used by the Ural mines:

Grade	Length of fibre in inches
0	over $1\frac{1}{4}$
1	$\frac{3}{4}$ - $1\frac{1}{4}$
II	5/8 - $\frac{3}{4}$
III	3/8 - 5/8
IV	1/8 - 3/8
V	less than 1/8

The inferior grades (IV and V) constitute about 65 per cent of the total production.

MINING AND MILLING

Canada

The methods by which asbestos is now mined in Quebec may be broadly classified as follows: (1) open pits; (2) "glory holes" and shrinkage slopes; and (3) combined open and underground workings. Methods used in mining slip-fibre differ from those used at cross-fibre deposits, for in the latter type the long fibre (crude Nos. 1 and 2) must be carefully separated from the mill fibre before milling, while in the slip-fibre deposits no such care is necessary and nearly the entire output of the mine is milled.

The earliest workings were all of the open-pit type and such operations are still the most common today. The methods of stripping the overburden vary, according to the depth, from simple hand methods to steam-shovel and hydraulic operations. After the rock is stripped the pits are carried downward in benches 20 to 75 feet high (average about 40 feet). After drilling and blasting the ore is further reduced in size by block-holing or mud-capping. Slip-fibre rock is then loaded directly into buckets or quarry cars by hand or by small steam shovels. Cross-fibre rock is first carefully sorted and rough-cobbed to remove all the crude grade, and the mill rock is then loaded into buckets for hoisting. The crude grade is re-cobbed, re-sorted, graded and packed in bags for shipment.

In open-pit operations involving the handling of crude, the cableway has survived throughout the life of the industry, and this method is still responsible for the greater proportion of the rock hoisted. Most of the rock mined in slip-fibre deposits comes from open pits, and the steam-shovel method has partly supplanted the cableway.

Where the open pits have become too deep for efficient operation, or where the over-burden is too heavy to be removed economically, underground or combination methods are used. In this case tunnels are driven under the pits and the ore milled down through "raises" into cars below (glory-hole system).

Milling methods, used at the various mills, vary in detail, but they are nearly all identical in principle. The objects of milling are to recover as much of the fibre as possible free from dirt and adhering rock and to handle the ore as gently as possible in order to minimize the reduction of fibre length by attrition. The general methods used are: coarse crushing, drying, re-crushing in stages, each stage being followed by screening, during which air suction effects the separation of the fibre from the rock gangue; collection of the fibre; cleaning of adhering dust and rock particles by re-screening; grading, and, finally, bagging for shipment. By the above milling methods all asbestos is recovered from its matrix by dry methods, but during the last year or so intensive experiments have been conducted with the object of developing a successful wet process. It is now claimed that a wet process has been perfected which shows, in comparative working tests, both economies in operation and more efficient extraction than is obtainable by any known dry process, a claim which, if demonstrable in practice, should do much to stabilize the industry.

South Africa and Rhodesia -

In the various sections of the Union and of Rhodesia both open-pit and underground mining methods are used. The ore is roughly hand-cobbed underground and the waste is allowed to accumulate in the workings so as to keep the floor within working distance of the roof.

Milling methods have usually been very simple in the past. In most cases the ore has been hand-cobbed, screened in hand sieves or simple mechanical screens, graded and bagged. At some of the operations in Rhodesia more elaborate methods of preparation are reported to be in use.

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